

S P E C I F I C A T I O N

[Title of the Invention]

Apparatus for reproducing data from an optical disc inducing vibration and method thereof

[Brief Description of the Drawings]

FIG. 1 is a conceptual diagram showing generation of a track traverse signal by vibration;

FIG. 2 is a block diagram showing an apparatus for reproducing a disc inducing vibration according to the present invention;

FIG. 3 is a voltage waveform which measures an actual track traverse signal over a full range of speed factors; and

FIG. 4 is a flowchart illustrating an example of a method for reproducing a disc inducing vibration according to the present invention.

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Field of the Invention and Related Art prior to the Invention]

The present invention relates to an apparatus for reproducing data from an optical disc, and more particularly, to an apparatus for reproducing data from an optical disc in which a disc inducing vibration is detected and its speed is converted into an appropriate reproducing speed.

Generally, an apparatus for reproducing an optical disc which is revolved by a motor can cause serious vibration according to the state of a medium, or cannot read recorded data due to instability of a servo state. The existing apparatuses for reproducing data from an optical disc make this disc inducing vibration operate normally by using a vibration sensor or actuator back electromotive force. For example, an apparatus for reproducing data from an optical disc having a vibration sensor increases the speed of a spindle motor so that the revolution speed of the disc is lowered with respect to the amount of a detected signal. Also, an optical disc reproducing apparatus using back electromotive force increases the speed of a

spindle motor so that the revolution speed of the disc is lowered by back electromotive force induced in an actuator. The operation steps are: 1) The number of revolutions of the spindle motor is increased to a target number of revolutions per minute (RPM); 2) Focus and tracking are switched to "OFF" states; 3) Back electromotive force induced in a tracking coil is amplified and then analogue-to-digital-converted; 4) Focus and tracking are switched to "ON" states.

However, the optical disc reproducing apparatus using the above vibration sensor has demerits in that sensing ability varies with the attaching location of a vibration sensor, and with respect to set's assembled state. In addition, the optical disc reproducing apparatus using actuator back electromotive force requires a comparator for checking actuator back electromotive force, and considerable time is spent checking a vibration-inducing disc after focus and tracking are off, until focus and tracking are reactivated after a vibration-inducing disc is checked. In addition, the method has another shortcoming in that a certain speed factor is fixed when a vibration-inducing disc is checked.

[Technical Goal of the Invention]

To solve the above problems, it is an objective of the present invention to provide an apparatus for detecting a disc inducing vibration and changing the revolution speed with respect to the frequency of vibration of the detected disc, and a method thereof.

[Structure and Operation of the Invention]

To accomplish the above object of the present invention, there is provided a method for reproducing data from a disc in a disc-reproducing system, the method having the steps of: counting the number of track traverse pulses which are generated when tracking is switched to "OFF" at the lowest speed factor; counting the number of track traverse pulses which are generated when tracking is switched to "OFF" at the highest speed factor; obtaining the frequency of vibration by subtracting the count value of track traverse pulses at the lowest speed factor from the count value of track traverse pulses at the highest speed factor; varying the

speed factor of reproducing data from the disc, by comparing the frequency of vibration with a predetermined base value.

Preferred embodiments of the present invention will now be described with reference to the attached drawings.

Among characteristics of a disc, a mass eccentric disc causes vibration in reproducing because it has a different center of gravity. An axial eccentric disc causes vibration in reproducing because it has a warped shape and the characteristics of mass eccentricity because of its twisted axis. A net eccentric disc does not cause vibration and only has an eccentric component because recording of the disc is twisted.

In a mass eccentric disc, unbalance in the weight causes a centrifugal force, and the shaft gap of the driving motor, when the disc operates, causes vibration of the motor axis. In addition, chucking of the turntable causes vibration of the axis. The vibration of a disc axis increases with respect to the speed and eccentric degree of a motor. When it is assumed that the pick-up is fixed, the axis vibration causes a disc to move from side to side with each revolution when seen from the object lens of the pick-up.

As a result, as shown in FIG. 1, with the pick-up unit 220 fixed, a disc is moved by axis variation (axis vibration), and the disc migration causes a track traverse signal in the form of analogue frequency. That is, 110 of FIG. 1 can be the migration length caused by the vibration. Using this track traverse signal, the present invention determines the frequency of vibration. A net eccentric disc causes a lot of track traverse signals both at a lower speed factor and at a higher speed factor. In addition, at a lower speed factor, an axial eccentric disc and a mass eccentric disc do not cause vibration and therefore, they cause little track traverse signals. At a higher speed factor, however, they cause vibration and therefore cause strong track traverse signals.

Accordingly, by comparing a track traverse signal at a lower speed factor with that at a higher speed factor, it is determined whether or not an axial eccentric disc or a mass eccentric disc causes the vibration.

FIG. 2 is a block diagram showing an apparatus for reproducing disc inducing vibration according to the present invention. The apparatus has a pick-up unit 220,

an error detecting unit 230, an error amplifying unit 240, a signal comparator 250, a microcomputer 260, and a spindle motor 270.

First, the pick-up unit 220 detects a tracking traverse signal of the revolving disc 210 when focus is "ON" and tracking is "OFF". At this time, the pick-up unit 220 is fixed to a predetermined voltage in the innermost circumference, when tracking is "OFF" for a full range of speed factors, in order to minimize an error from shaking and a measuring error.

The error detecting unit 230 calculates the tracking traverse signal, detected in the pick-up unit 220, in an E-F form. The error amplifying unit 240 differentially-amplifies the E-F form traverse signal calculated in the error detecting unit 230. After comparing the tracking traverse signal amplified in the error amplifying unit 240 and a base signal, the signal comparator 250 generates a pulse signal. By counting pulse signals generated in the signal comparator 250 at the lowest speed factor of a disc and at the highest speed factor of the disc, the microcomputer 260 determines the frequency of vibration. With respect to the frequency of vibration, the revolution number of the spindle motor is varied. That is, in order to determine whether or not a disc is axial eccentric or mass eccentric, the microcomputer 260 subtracts the counted value of the track traverse signal at a lower speed factor from the counted value of the track traverse signal at a higher speed factor. The frequency of vibration is detected by dividing the difference of the counted value by the revolution number of the spindle. Then, the revolution speed is varied by comparing the frequency of vibration with a base value. For example, when the frequency of vibration is equal to or over 80Hz, 16 times speed, that is, a lower speed factor is set because the vibration is great. When the frequency of vibration is equal to or over 40Hz, 20 times speed is set. When the frequency of vibration is less than 40Hz, 24 times speed, that is, a higher speed factor is set because the vibration is small. After setting a speed factor, the microcomputer 160 switches tracking "ON" and resumes normal reproduction of data from the disc.

FIG. 3 is a voltage waveform which measures an actual track traverse signal over a full range of speed factors in order to reduce disc shaking and measuring errors.

Referring to FIG. 3, the microcomputer 260 switches tracking "OFF" by applying track-off voltage to the pick-up driving motor. In this state, the microcomputer 260 checks the innermost circumference of the disc. After a predetermined time passes, that is, after about 3 revolutions of the disc (about 100ms delay), the microcomputer 260 counts the number of pulses of a track traverse signal.

FIG. 4 is an example of a method for reproducing data from a disc inducing vibration according to the present invention.

First, in step 410, the disc is started up by switching focus "ON" and switching tracking "OFF".

In step 420, the innermost circumference of the disc is checked by switching tracking "OFF" at 1 times speed, that is, the lowest speed factor. After a predetermined time passes, the number of track traverse pulses is counted.

In step 430, the constant angular velocity (CAV), which increases from inner circumferences to outer circumferences, is started.

In step 440, the disc is revolved until the speed reaches 3700RPM.

In step 450, when the speed reaches 3700RPM, tracking is switched to "OFF" at the highest speed factor, for example, at 24 times speed. Then, at a predetermined time after checking the innermost circumference of the disc, the number of pulses of the track traverse signal is measured.

In step 460, the frequency of vibration is measured by subtracting the number of traverse pulses at the lowest speed factor (1 times speed) from the number of traverse pulses at the highest speed factor (24 times speed).

In steps 470 and 480, the measured frequency of vibration is compared with the frequency of vibration predetermined as a basis (for example, 80Hz and 40Hz).

In steps 472, 482 and 484, when the measured frequency of vibration is equal to or more than the predetermined frequency of vibration (80Hz), the disc is determined to have a great vibration and 16 times speed, that is, a lower speed factor is set in order to reduce vibration. When the measured frequency of vibration is less than 80Hz and equal to or greater than 40Hz, 20 times speed is set. When the measured frequency of vibration is less than 40Hz, the disc is determined to

have a small vibration and 24 times speed, that is, a higher speed factor is set. At this time, the base of speed factor can be set at equal to or less than 45dB noise.

[Effect of the Invention]

As described above, according to the present invention, an appropriate speed factor can be set with respect to the frequency of vibration of a disc. Also, since the frequency of vibration is checked when focus is "ON", tracking becomes faster, which is advantageous.